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PATENT SPECIFICATION

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(19)

(54) IMPROVEMENTS IN OR RELATING TO ROTATING MACHINE WINDING INSULATION

(71) We, BBC BROWN BOVERI & COMPANY, LIMITED, of Baden, Switzerland, a Swiss Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns a method of insulating the winding conductors of rotating high-voltage machines with mica and synthetic resin.

The windings of rotating high-voltage machines are usually insulated by the two methods whereby in both cases tapes or foils containing mica are wrapped round the conductors a number of times until the required thickness of insulation is achieved, the conductors in one case then being impregnated with synthetic resin and cured, while in the other case the impregnating agent is already present in the tape or foil so that it then only has to be cured.

These known methods of insulation, which exhibit high-grade mechanical, thermal and electrical properties, have the disadvantage, however, that because the insulation has to be built up from a large number of layers of tape or foil, production is very time-consuming and expensive, particularly in the case of high-voltage machines which need a conductor insulation having a thickness of several millimetres.

The object of the invention is to create a method of insulating the winding conductors of rotating high-voltage machines with mica and synthetic resin which is simpler and economic.

In accordance with the present invention there is provided a method of insulating a winding conductor of a rotating high-voltage machine with mica and synthetic resin, the insulation comprising a mixture of mica in powder form and a synthetic resin in the B-state, the insulation being applied under pressure to the conductor in a single layer which forms the total required thickness of insulation and the insulation being cured at elevated temperature.

The invention also includes an electrical machine winding which includes a multi-bar conductor contained within an insulation sheath composed of an unwound, unlapped single layer of resin and mica insulation applied by the method set forth in the preceding paragraph.

Two examples of the invention will now be explained in more detail with reference to the accompanying diagrammatic drawing, which shows in Figures 1 and 2, cross-sections through respective insulated bar conductors which are partially illustated in perspective.

In Figure 1 a strip of insulation, comprising a mixture of mica in powder form and an already partly cured synthetic resin (e.g. epoxide resin) i.e. in the B-state, is folded in a single layer 2 round the bar conductor 1, the dimensions of the insulating layer being so chosen that it just covers all the longitudinal surfaces of the conductor. The bar conductor 1 enclosed in the layer of insulation 2 is then subjected to pressure in a moulding press and cured at elevated temperature, whereupon the butt joint 3 shown in the figure is eliminated by fusion of the opposed edges of the insulation.

In the version shown in Figure 2 the layer of insulation is divided into a number of longitudinal strips 4 and 5, the length of which in each case is equivalent to the length of the conductor 1. The strips 4 and 5 are applied to the conductor (with the synthetic resin in the B-state), the assembly of conductor and insulation is subjected to pressure in a moulding press, and the insulation is cured at elevated temperature. Figure 2 shows the conductor with its layer of insulation in the compressed and cured state, with the joints between strips 4 and 5 being free of any gaps.

The proportion of mica in the insulation should preferably be between 60 and 80%.

Also, to improve the mechanical strength of the insulation approximately 5 to 15% fibre material (e.g. glass fibre) should be added to the synthetic resin/mica mixture.

The methods described provide a very simple means of insulation, the insulation having no gaps and being homogeneous over the entire length of the conductor. In addition, since the multi-bar conductors of high-voltage machines are usually transposed after the manner of the Roebel bar, when the insulating layer is compressed the voids on the narrow sides of the conductor at the points of transposition are at the same time homogeneously filled with insulation.

WHAT WE CLAIM IS:—

1. A method of insulating a winding conductor of a high-voltage machine with mica and synthetic resin, the insulation comprising a mixture of mica in powder form and a synthetic resin in the B-state, the insulation being applied under pressure to the conductor in a single layer which forms the total required thickness of insulation and the insulation being cured at elevated temperature.

2. A method as claimed in claim 1, in which the insulation is applied to the conductor as a single strip which, prior to application of the pressure, substantially completely encloses the longitudinal surfaces of the conductor.

3. A method as claimed in claim 1, in which the insulation is applied to the conductor as a plurality of strips which extend parallel to the conductor and over the length thereof, the strips being conjoined during application of the pressure to provide the single layer of insulation.

4. A method as claimed in any one of claims 1 to 3 in which the proportion of mica powder in the insulation is between 60 and 80% by weight.

5. A method as claimed in any one of claims 1 to 4, in which 5 to 15% fibre material by weight is contained in the insulation.

6. An electrical machine winding including a multi-bar conductor which is contained within an insulation sheath composed of an unwound, unlapped single layer of resin and mica insulation applied by the method claimed in claim 1.

7. A machine as claimed in claim 6, in which the bar comprises a Roebel bar.

8. The method claimed in claim 1 carried out substantially as described with reference to either Figure 1 or Figure 2 of the accompanying drawing.

9. An electrical machine winding having conductors insulated by the method claimed in any one of claims 1 to 5 or Claim 8.

MARKS & CLERK

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1432214 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

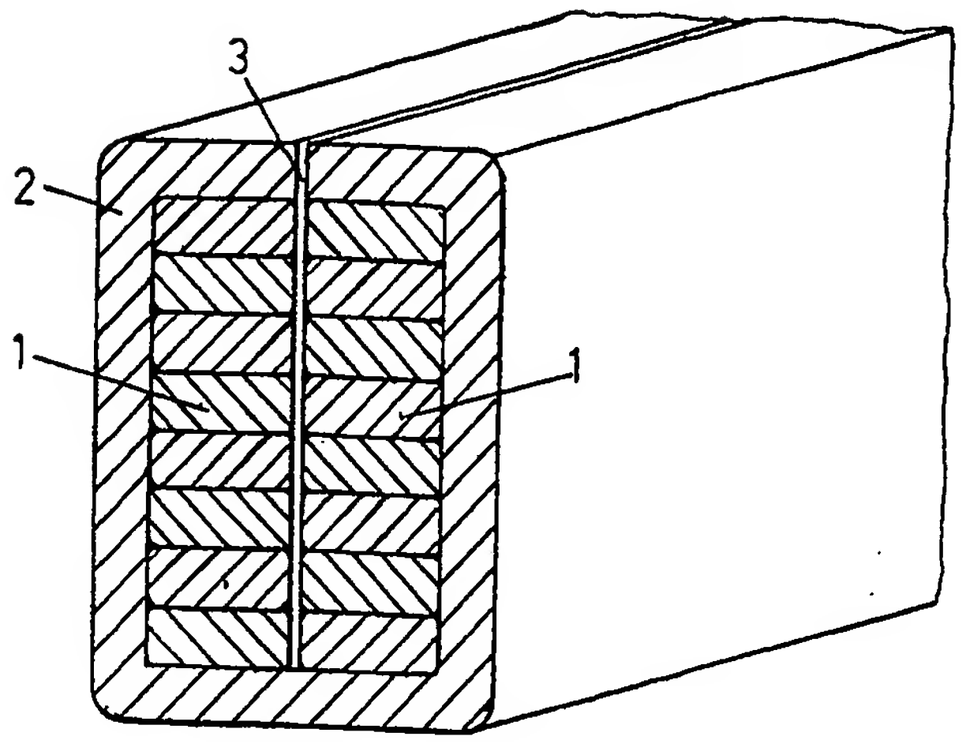

FIG.1

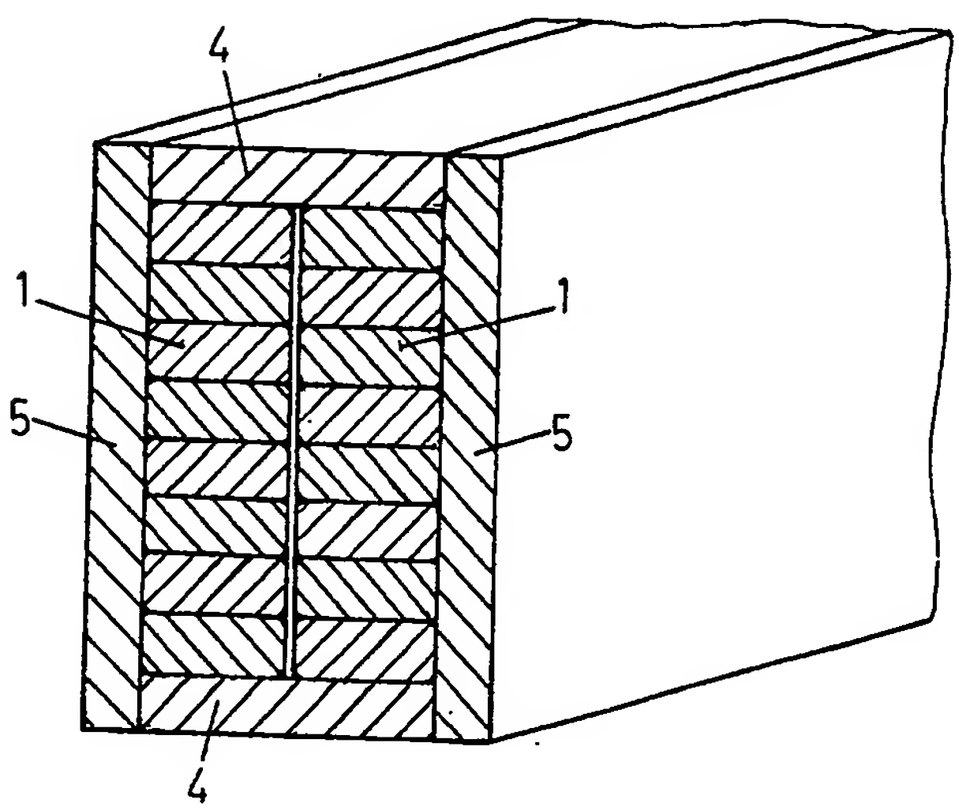

FIG.2